CLAIMS

1. A liquid crystal display apparatus comprising a first substrate (21b) having a first transparent electrode (22b) and a second substrate (21a) having a second transparent electrode (22a), liquid crystal devices (2) holding a nematic liquid crystal layer (24) which is twist-oriented by an STN-twist angle between the first and second substrates; a first polarization board (1) provided for an outside of the first substrate; a twisted phase difference board (3) provided for the outside of the second substrate and having liquid crystal polymer layers (32a, 32b); and a second polarization board (4) provided for the outside of the twisted phase difference board; characterized in that,

the direction of the twist angle of molecule orientation of the twisted phase difference board (3) is reverse to the direction of the twisted orientation of the liquid crystal molecule of the liquid crystal devices (2), and the twist angle of the twisted phase difference board is smaller than the twist angle of the liquid crystal devices (2) by 10° to 40°.

2. A liquid crystal display apparatus as claimed in claim 1, wherein the STN-twist angle lies in the range of 180° to 270°.

3. A liquid crystal display apparatus as claimed in claim 2, wherein

an angle between the liquid crystal molecule-oriented direction of the alignment film (23a) of the second substrate and the molecule-oriented direction of a lower polymer (32b) of the liquid crystal polymer layer lies in the range of 80° to 90°;

an angle between an absorption axis of the first polarization board (1) and the liquid crystal molecule-oriented direction of the alignment film (23b) of the first substrate side lies in the range of 50° to 60°; and

an angle between the absorption axis of

the second polarization board (4) and the molecule-oriented direction of an upper polymer (32a) of the liquid crystal polymer lies in the range of 30° to 40°.

4. A liquid crystal display apparatus as claimed in claim 2, wherein

in the relationship between a retardation $\Delta nd1$ obtained by product of a double refractive index $\Delta n1$ of the nematic liquid crystal layer (24) and a thickness d1 of the liquid crystal layer, and a retardation $\Delta nd2$ obtained by product of the double refractive index $\Delta n2$ of the liquid crystal polymer layer and the thickness d2 of the liquid crystal polymer layer,

the retardation $\Delta nd1$ lies in the range of 0.7 to 0.9 μm, and

the difference $\Delta nd1 - \Delta nd2$ lies in the range of 0.1 to 0.3 μm.

5. A liquid crystal display apparatus as claimed in claim 2, wherein

an angle between the liquid crystal molecule-oriented direction of the alignment film (23a) of the second substrate and the molecule-oriented direction of a lower polymer (32b) of the liquid crystal polymer layer lies in the range of 80° to 90°;

an angle between an absorption axis of the first polarization board (1) and the liquid crystal molecule-oriented direction of the alignment film (23b) of the first substrate side lies in the range of 50° to 60°;

an angle between the absorption axis of the second polarization board (4) and the molecule-oriented direction of an upper polymer (32a) of the liquid crystal polymer lies in the range of 30° to 40°; and

in the relationship between a retardation $\Delta nd1$ obtained by product of a double refractive index

$\Delta n1$ of the nematic liquid crystal layer (24) and a thickness d1 of the liquid crystal layer, and a retardation $\Delta nd2$ obtained by product of the double refractive index $\Delta n2$ of the liquid crystal polymer layer and the thickness d2 of the liquid crystal polymer layer, the retardation $\Delta nd1$ lies in the range of 0.7 to 0.9 μm, and the difference $\Delta nd1 - \Delta nd2$ lies in the range of 0.1 to 0.3 μm.

6. A liquid crystal display apparatus as claimed in claim 2, wherein a preferential view direction of the liquid crystal devices (2) is set to any one direction of the hands of a clock showing two-thirty, four-thirty, seven-thirty or ten-thirty.

7. A liquid crystal display apparatus as claimed in claim 3 or 5, wherein the second polarization board (4) and the twisted phase difference board (3) structures a bonded unit; and the bond unit is structured by superposing upon the second polarization board of the rolled film and the twisted phase difference board of the rolled film, and adhering them for the same roll-out direction, by utilizing the angle between the absorption axis of the second polarization board (4) and the molecule-oriented direction of the upper polymer (32a) of the liquid crystal polymer layer being in the range of 30° to 40°.

8. A liquid crystal display apparatus as claimed in claim 7, wherein the bonding unit is structured by superposing upon the rolled films each other and adhering them for the same direction, and by cutting it to a predetermined size.

9. A liquid crystal display apparatus as claimed in claim 2, wherein the liquid crystal polymer layer of the twisted phase difference board has a temperature compensating characteristic in a predetermined temperature range.

10. A liquid crystal display apparatus as claimed in claim 9, wherein the liquid crystal polymer layer has a temperature compensating characteristic in which the retardation (Δnd2) of the liquid crystal polymer layer is always smaller than the retardation (Δnd1) of the nematic liquid crystal layer in a predetermined temperature range.

11. A liquid crystal display apparatus as claimed in claim 10, wherein the predetermined temperature range lies in the range of 20° to 80°.

12. A liquid crystal display apparatus comprising a first substrate (21b) having a first transparent electrode (22b) and a second substrate (21a) having a second transparent electrode (22a), liquid crystal devices (2) holding a nematic liquid crystal layer (24) which is twist-oriented by an STN-twist angle in the range of 180° to 270° between the first and second substrates; a first polarization board (1) provided for an outside of the first substrate; a twisted phase difference board (3) provided for the outside of the second substrate and having liquid crystal layers (32a, 32b); and a second polarization board (4) provided for the outside of the twisted phase difference board; characterized in that,

a) the direction of the twist angle of molecule orientation of the twisted phase difference board (3) is reverse to the direction of the twisted orientation of the liquid crystal molecule of the liquid crystal devices (2), and the twist angle of the twisted phase difference board is smaller than the twist angle of the liquid crystal devices (2) by 10° to 40°;

b) an angle between the liquid crystal molecule-oriented direction of the alignment film (23a) of the second substrate and the molecule-oriented direction of a lower polymer (32b) of the liquid crystal polymer layer lies in the range of 80° to 90°;

c) an angle between an absorption axis of the first polarization board (1) and the liquid crystal molecule-oriented direction of the alignment film (23b) of the first substrate side lies in the range of 50° to 60°;

d) an angle between the absorption axis of the second polarization board (4) and the molecule-oriented direction of an upper polymer (32a) of the liquid crystal polymer lies in the range of 30° to 40°;

e) in the relationship between a retardation $\Delta nd1$ obtained by product of a double refractive index $\Delta n1$ of the nematic liquid crystal layer (24) and a thickness d1 of the liquid crystal layer, and a retardation $\Delta nd2$ obtained by product of the double refractive index $\Delta n2$ of the liquid crystal polymer layer and the thickness d2 of the liquid crystal polymer layer, $\Delta nd1$ lies in the range of 0.7 to 0.9 μm, and the difference $\Delta nd1 - \Delta nd2$ lies in the range of 0.1 to 0.3 μm;

f) the second polarization board (4) and the twisted phase difference board (3) structure a bonded unit; and the bond unit is structured by superposing upon the second polarization board of the rolled film and the twisted phase difference board of the rolled film, adhering them for the same roll-out direction, and cutting it to a predetermined size; and

g) the liquid crystal polymer layer has a temperature compensating characteristic in which the retardation ($\Delta nd2$) of the liquid crystal polymer layer is always smaller than the retardation ($\Delta nd1$) of the nematic liquid crystal layer in a predetermined temperature range.

13. A method for manufacturing a liquid crystal display apparatus comprising a first substrate (21b)

having a first transparent electrode (22b) and a second substrate (21a) having a second transparent electrode (22a), liquid crystal devices (2) holding a nematic liquid crystal layer (24) which is twist-oriented by an STN-twist angle in the range of 180° to 270° between the first and second substrates; a first polarization board (1) provided for an outside of the first substrate; a twisted phase difference board (3) provided for the outside of the second substrate and having liquid crystal polymer layers (32a, 32b); and a second polarization board (4) provided for the outside of the twisted phase difference board; wherein an angle between an absorption axis of the second polarization board (4) and a molecule-oriented direction of an upper polymer (32a) of the liquid crystal polymer layer lies in the range of 30° to 40°; characterized in that,

a) the second polarization board (4) is structured by rolled film;

b) the twisted phase difference board is structured by the rolled film;

c) the roll-out direction of the rolled film of the second polarization board and the roll-out direction of the rolled film of the twisted phase difference board are arranged in the same direction by utilizing an angle being in the range of 30° to 40°;

d) the rolled film of the second polarization board and the rolled film of the twisted phase difference board are superposed upon each other and adhered them in the roll-out direction; and

e) a bonding unit is made by cutting the rolled film in a predetermined size after adhesion and bonding the second polarization board and the twisted phase difference board.

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